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METHOD AND DEVICE FOR PRODUCING CASTING CORES AND/OR CASTING MOLDS

The invention relates to a method for producing casting cores and/or casting molds with a core shooter and/or molding machine with at least one shooting unit comprising a shooting head filled with a material to be shaped, especially a mixture of core or molding sand with a binder. Said mixture is shot into a mold or form tool by supplying pressurized air through a shooting board, which comprises at least one shooting opening.

The invention further relates to a device for producing casting cores and/or casting molds with at least one shooter having a shooting head to be filled with material to be shaped, especially core or molding sand with a binder, with a shooting cylinder for supplying compressed air while shooting, and with a shooting board having at least one shooting opening.

A method, as well as a device for performing this method, are generally known, for example, from DE 37 15 997 C2.

In the casting industry, work is performed with casting cores or casting molds, which are composed of sands mixed from a mineral base material (e.g., quartz, chromite, olivine, or zirconium sand), a binding component (either organic resin or inorganic aqueous glass), as well from at least one hardener matched to the binder. According to the production process, this material to be shaped is first compressed in heated or unheated modeling tools and then solidified through heat or alternatively through feeding gas with a suitable gaseous hardener.

The mentioned compression of the material to be shaped in the modeling tool is realized through "shooting," that is, the material to be shaped is injected all at once into a molding or core box with the help of compressed air. Due to the binder components present in the material to be shaped, according to the viscosity of this material to be shaped, continuous air channels can be formed from the top through the material to be shaped to the shooting openings in the shooting board. Thus, in a renewed shooting process, only very little or possibly absolutely no material to be shaped at all still flows through the shooting openings into the molding tool.

The material to be shaped forming the air channels can begin to harden between the individual shooting processes, primarily in the so-called dead zones at the side of the shooting openings, and therefore can also form solid chunks. If a shooting board with a different arrangement of shooting openings is used in the core shooter for successive shooting processes, which can occur quite often, solidified chunks of the material to be shaped can mix with the fresh material to be shaped, which reduces the quality of the core to be produced.

Therefore, the objective arises of providing a method of the above-noted type, as well as a device for performing this method, wherein the formation of air channels, bridges, and other undesired structures can be avoided in the material to be shaped found in the shooter.

To address this objective, the material to be shaped located in the shooter is mechanically loosened up during and/or after the shooting. Through such a loosening process, the solidification of the material to be shaped and an accompanying production of air channels, bridges, or other structures within the material to be shaped can be prevented.

The loosening can be particularly effective and useful when the material to be shaped is mixed during loosening. By means of the mixing, the material to be shaped is moved, such that binding of the individual components into solid chunks is prevented. In addition, the material to be shaped can also be remixed after injection into the shooter. In this way, the mixing is improved and demixing during injection into the shooter is counteracted.

The device for performing the described method is characterized to meet this objective in that at least one movable mixing tool is arranged at least in the shooting head. This mixing tool can loosen and thoroughly mix the material to be shaped that is present in the shooting unit, in that it is moved through the material to be shaped. In this way, forming or already formed structures in the material to be shaped can also be destroyed and the homogeneity of the material to be shaped can be increased.

Here, it is advantageous if the mixing tool can be driven in the shooting head, in particular, so that it rotates, preferably about the longitudinal center axis of the shooting head. The injection with the material to be shaped and also the downwards shooting of the material to be shaped through the shooting openings of the shooting board also occur in the direction of the longitudinal axis of the shooting unit. Therefore, a mixing tool arranged in this way can be easily inserted into the shooting unit and reached therein.

Here, it is useful if the mixing tool has a drive, which drives the rotating shaft directed along the longitudinal center axis of the shooting unit. At least one projecting mixing vane is arranged on this shaft. Therefore, the rotating mixing tool can effectively prevent or, if necessary, destroy air channels running along the longitudinal axis of the shooting head or shooting cylinder, because the projecting mixing vane or vanes work perpendicular to the air channels.

So that the material to be shaped can be loosened and mixed thoroughly at any time, it is advantageous if the drive can be controlled before, during, and/or after the shooting. Thus, the loosening can begin already shortly after the filling of the shooting unit and thus premature solidification of the material to be shaped can be prevented.

In the lower region of the shooting unit, especially in the region of the shooting board with its shooting openings, it is especially important that excess material to be shaped remaining after the shooting process does not bind into larger chunks and is not carried along or broken up into the mold during the following shooting processes or does not produce air channels between these processes. Therefore, it is useful if the mixing tool is arranged close to the shooting board, especially in the center region of the shooting head. In addition, forming or already formed structured, such as, for example, air channels in the material to be shaped, can collapse due to this mixing tool located in the lower region of the shooting unit.

For easy maintenance of the drive of the mixing tool, it is advantageous if the drive is arranged at the upper end of the shaft and preferably in the upper part of the shooting unit. Therefore, the drive is also mounted outside of the region filled by the material to be shaped and therefore can be exposed to less of the loading due to contaminants and material to be shaped.

In order to provide good loosening and mixing of the material to be shaped in all regions, it is useful if several, and preferably three, mixing vanes are arranged on the shaft. The mixing vanes can be distributed over the shaft of the mixing tool. According to the structure of the shooting unit, a uniform distribution or also different distances between the mixing vanes can be preferred.

Especially advantageous for the effective prevention or elimination of already present, perpendicular air channels or also structures extending in different directions in the material to be shaped is when the mixing vanes are aligned radially to the shaft, thus, usually horizontally. In the rotation of the shaft and the mixing vanes attached thereto, the material to be shaped can be loosened and mixed thoroughly perpendicular to its direction of motion that it has during filling of the shooting unit, as well as during shooting.

In order to be able to reach the entire region of the shooting cylinder, as well as the shooting head, as much as possible for the mixing tool and in order to be able to loosen as much as possible all of the material to be shaped, it is useful if the length of the mixing vane in the shooting cylinder corresponds approximately to the radius of the cross section of the shooting cylinder and the lower mixing vane in the shooting head is longer than the mixing vane in the shooting cylinder and reaches at least to the shooting openings and/or projects past the shooting openings. Thus, good prevention of deposits of material to be shaped from earlier shooting processes can be achieved, primarily in the region of the shooting openings and at the wall regions in the shooting cylinder.

Here, it is also advantageous if the shaft extends with its lower free end nearly up to the shooting board and if the mixing vane near the shooting board is arranged at or near the lower free end of the shaft. Thus, primarily the region directly next to the shooting openings can be kept free from deposits.

The mixing tool can be provided advantageously so that the mixing vane is assembled from several individual vanes, preferably from at least two individual vanes forming a mixing vane pair and when the individual vanes

are mounted with their inner end on the shaft of the mixing tool and point with their outer, free end radially in various directions. Therefore, even for a slow rotational rate of the shaft, an effective thorough mixing of the material to be shaped takes place, because many individual vanes move in the material to be shaped and loosen it up.

For the simple maintenance of the entire shooting unit, it is useful if the mixing tool is mounted detachably to the drive and can be removed therefrom. Therefore, the shooting cylinder can be accessed more easily when the shaft of the mixing tool passing through it can be removed easily.

In order to be able to easily remove the residual material to be shaped that is loosened by the mixing tool, especially after the shooting process, from the shooting cylinder and the shooting head, it is advantageous if a discharge opening for removing the excess material to be shaped is provided in the shooting head. Here, for example, a low pressure, which can suction the material to be shaped from the shooting unit, can be applied to the discharge opening.

Embodiments of the invention are described in more detail below with reference to the drawing. Shown in partially schematized representation are:

Figure 1 a side view of a device for producing casting cores and/or casting molds of the prior known construction with deposits of excess material to be shaped in the region of the shooting head,

Figure 2 a side view of a device for producing casting cores and/or casting molds of the prior known construction which has air channels from excess material to be shaped in the region of the shooting cylinder and deposits in the region of the shooting head, and

Figure 3 a side view of a device according to the invention for producing casting cores and/or casting molds with a mixing tool in the region of the shooting cylinder and the shooting head and a mold for the casting core to be produced underneath the shooting board.

A device designated as a whole with 1 and shown in Figure 3 for producing casting cores and/or casting molds has a shooting unit 2 with a shooting head 4, which is filled with a material to be shaped 50. Compressed air to is fed to the shooting head 4 through a shooting cylinder 3 by which the material to be shaped 50 is shot from the shooting head 4 through a shooting board 5 with one or more shooting openings 6 into a mold 100, whose inner hollow space 101 has the contours of the core to be formed.

In the shooting head 4, as well as in the shooting cylinder 3, a moveable mixing tool 7 is located, with which the material to be shaped 50 can be mechanically loosened and mixed.

As can also be recognized in Figure 3, the mixing tool 7 has a shaft 9, which extends along the longitudinal center axis of the shooting unit 2 and which can be driven and therefore set in rotation by means of a drive 8 that can be controlled before, during, or after the shooting process. Several projecting mixing vanes 10 are arranged on the shaft 9, which can loosen and mix the material to be shaped 50 through the rotational motion of the shaft 9 and which can also eliminate air channels 51 or bridges in the material to be shaped 50 produced in a previous shooting process.

Such air channels 51 in the material to be shaped 50 are shown in Figure 2 using the example of a conventional shooting unit 2, wherein it becomes clear

that the material to be shaped 50 can already be solidified partially in the wall region of the shooting cylinder 3 and the shooting head 4, so that it also settles on the walls of the shooting cylinder 3 and shooting head 4. Through a timely or constant movement of the material to be shaped 50 by the mixing tool 7, solidification, for example, through binding, and a production of air channels 51 can be prevented or such air channels 51 can be eliminated again during or after their production.

Here, the mixing tool 7 is arranged in the center region of the shooting head 4 close to the shooting board 5, in order to be able to loosen material to be shaped 50 there and therefore to prevent the production of chunks made from bound material to be shaped 50. Such possibly growing deposits are illustrated in Figure 1 and Figure 2, which show a conventional shooting unit 2.

The drive 8 is arranged at the upper end of the shaft 9 and thus outside of the region of the shooting cylinder 3 filled with material to be shaped 50, as shown in Figure 3. It can also be recognized from Figure 3 that three mixing vanes 10 are arranged on the shaft 9, wherein in this embodiment, the horizontally oriented mixing vanes 10 each comprise a mixing vane pair, whose individual vanes project radially from the shaft 9 in different directions. The length of the mixing vanes 10 or the individual vanes here corresponds approximately to the radius of a cross section of the shooting cylinder 3. The lower mixing vane pair, which is located in the shooting head 4 close to the shooting board 5 and at the lower end of the shaft 9, here has a somewhat longer mixing vanes 10, in order to be able reach up to the shooting openings 6 of the shooting board 5 or to extend past the openings in order to be able to remove the existing or forming deposits made from material to be shaped 50.

Figure 3 also shows that a discharge opening 11, which can be used for removing the excess material to be shaped 50 from the shooting head 4, is provided in the shooting head 4. Here, the lower mixing vane pair can be embodied so that it leads the excess material to be shaped 50 to the discharge opening 11. A transport device 12, which is operated, for example, with compressed air and which leads away the excess material to be shaped 50 with low pressure, can be connected to the discharge opening 11.